What is claimed is:

1. A heat transfer system which comprises:

a hollow supply tube having a proximal end and a distal end;

a capillary tube having a proximal end and a distal end with the proximal end thereof connected in fluid communication with the distal end of said supply tube, said capillary tube being formed with a lumen having a length "l" and a diameter "d";

a tip member positioned to surround the distal end of said capillary tube to create a cryo-chamber therebetween; and

a source of refrigerant fluid connected in fluid communication with the proximal end of the supply tube to introduce the refrigerant fluid into the supply tube at a working pressure "p_w" for transfer of the refrigerant fluid through said supply tube and through said capillary tube for exit from the distal end of said capillary tube and into said cryo-chamber in a substantially liquid state for transition of the refrigerant fluid into a gaseous state with a tip pressure "p_t" and a tip temperature "t_t" for heat transfer through said tip member and into the gaseous fluid refrigerant in said cryo-chamber.

2. A system as recited in claim 1 wherein said supply tube is formed with a lumen having a length "l_s" and a diameter "d_s", and wherein the diameter of the lumen of said capillary tube "d" is less than the diameter "d_s" and "l_s" is less than or equal to the length "l".

3. A system as recited in claim 1 wherein an aspect ratio "d/l" for the capillary tube is in a range of 0.0008 to 0.0017.

4. A system as recited in claim 3 wherein the length "l" of said capillary tube is in a range between approximately four and one half inches and approximately ten inches.

5. A system as recited in claim 4 wherein the diameter "d" of said capillary tube is 0.008 inches.

6. A system as recited in claim 1 wherein the refrigerant fluid is nitrous oxide (N_2O).

7. A system as recited in claim 1 wherein the working pressure "p_w" is in a range between three hundred and fifty psia and five hundred psia.

8. A system as recited in claim 7 wherein the tip pressure "p_t" is less than one atmosphere.

9. A system as recited in claim 8 wherein the tip temperature "p_t" is less than minus eighty four degrees Centigrade ($p_t < -84°C$).

10. A heat transfer system which comprises:

a means for providing a liquid refrigerant at a first pressure;

a means for reducing the pressure on the liquid refrigerant from the first pressure to a second pressure; and

a means for introducing the liquid refrigerant into a cryo-chamber at the second pressure for transition of the liquid refrigerant into a gaseous state in the cryo-chamber to cause heat to transfer from outside the cryo-chamber and into the cryo-chamber.

11. A system as recited in claim 10 wherein said reducing means comprises:

a hollow supply tube having a proximal end and a distal end; and

a capillary tube having a proximal end and a distal end with the proximal end thereof connected in fluid communication with the distal end of said supply tube, said capillary tube being formed with a lumen having a length "l" and a diameter "d" wherein an aspect ratio "d/l" for the capillary tube is in a range of 0.0008 to 0.0017.

12. A system as recited in claim 11 wherein the length "l" of said capillary tube is in a range between approximately four and one half inches and approximately ten inches and the diameter "d" of said capillary tube is in a range between approximately 0.008 inches and approximately 0.010 inches.

13. A system as recited in claim 10 wherein the first pressure is a working pressure "p_w" in a range between three hundred and fifty psia and five hundred psia and the second pressure is a tip pressure "p_t" less than one atmosphere.

14. A system as recited in claim 13 wherein the refrigerant in the gaseous state in the cryo-chamber has a tip temperature "t_t" less than minus eighty four degrees Centigrade ($p_t < -84°C$).

15. A system as recited in claim 10 wherein the liquid refrigerant is nitrous oxide (N_2O).

16. A method for transferring heat which comprises the steps of:

providing a liquid refrigerant at a first pressure;

reducing the pressure on the liquid refrigerant from the first pressure to a second pressure; and

introducing the liquid refrigerant into a cryo-chamber at the second pressure for transition of the liquid refrigerant into a gaseous state in the cryo-chamber to cause a transfer of heat outside the cryo-chamber and into the cryo-chamber.

17. A method as recited in claim 16 wherein said reducing step comprises the steps of:

advancing the liquid refrigerant through a hollow supply tube to a capillary tube having a proximal end and a distal end; and

causing the liquid refrigerant to flow through the lumen of the capillary tube wherein the lumen of the capillary tube has a length "l" and a diameter "d" with an aspect ratio "d/l" for the capillary tube in a range of 0.0008 to 0.0017.

18. A method as recited in claim 17 wherein the length "l" of said capillary tube is in a range between approximately four and one half inches and approximately ten inches and the diameter "d" of said capillary tube is in a range between approximately 0.008 inches and approximately 0.010 inches.

19. A method as recited in claim 16 wherein the first pressure is a working pressure "p_w" in a range between three hundred and fifty psia and five hundred psia and the second pressure is a tip pressure "p_t" less than one atmosphere.

20. A method as recited in claim 16 wherein the liquid refrigerant is nitrous oxide (N_2O) and when in the gaseous state in the cryo-chamber has a tip temperature "t_t" less than minus eighty four degrees Centigrade (p_t < -84°C).